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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/804,713	03/18/2004	Chao-Hsiang Yang	67,200-967	7508

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EXAMINER	
MONDT, JOHANNES P	

ART UNIT	PAPER NUMBER
3663	

DATE MAILED: 09/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/804,713	YANG, CHAO-HSIANG	
	Examiner	Art Unit	
	Johannes P. Mondt	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 August 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,6,9-14,16-20,22-25 and 28* is/are pending in the application.

4a) Of the above claim(s) *14 and 16-20* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3, 6, 9-13, 22-25 and 28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendment filed 8/14/06 in conjunction with the Amendment filed 3/30/06 (entered in light of the Request for Continued Examination filed 5/5/06 forms the basis for this office action. In said Amendment applicant elected Species I and stated that claims 1-3, 6, 9-13, 22-25 and 28 read on the elected species, and accordingly has withdrawn claims 14-21 and 26. Comments on Remarks submitted with said Amendment and with the Request for Continued Examination filed 5/5/06 are included below under "Response to Arguments".

Election/Restrictions

The election was made with traverse, however, no arguments have been presented with said traverse, and hence the election will be treated as one without traverse. Applicant is referred to MPEP 818.03[b]:

"The election of an invention or species may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse.

Should applicant traverse on the ground that the inventions or species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions or species to be obvious variants or clearly admit on the record that this is the case.

In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C.103(a) of the other invention".

Accordingly, the election of species requirement is deemed correct and herewith is made FINAL.

Drawings

The drawings are objected to under 37 CFR 1.83(b) because they are incomplete. 37 CFR 1.83(b) reads as follows:

> When the invention consists of an improvement on an old machine the drawing must when possible exhibit, in one or more views, the improved portion itself, disconnected from the old structure, and also in another view, so much only of the old structure as will suffice to show the connection of the invention therewith.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the

examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

1. In particular, Figure 2 illustrates fuse 66 on a single "topmost metal line" 64, however, above 64 on the left there is shown an un-identified structure having V- or U-shape contacting the other of the two layers 64 from above. The Replacement Sheet should identify said structure by numeral and clarify the connection of said structure with the elements in the disclosure. No new matter should be introduced.
2. Furthermore, cross-sectional view provided by Figure 2 is in no definite way connected in the specification with another side view such as provided for embodiment shown in Figure 3. In particular the claimed "electrical communication between said at least two top metal lines by spanning a distance between said at least two top metal lines" as claimed (claim 1) is not illustrated and should be illustrated by providing an additional Figure showing a side view such as Figure 3 but for the embodiment of Figure 2, by which the line along which the cross-sectional view provided in Figure 2 should be indicated. No new matter should be introduced.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. ***Claims 1-3*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US 20022002/0079552 A1) in view of Tatematsu et al (US 2002/0153588 A1).

Koike teaches as a semiconductor device fuse structure *capable* of preventing a dielectric layer from cracking at corner portions of associated metallization structures, comprising:

a substrate 11 ([0053]);

a top inter-metal dielectric layer 29 ([0056]) on said substrate;

at least two top metal lines comprising copper (copper interconnection 32 centrally located in the lateral sense within 29 ([0056]) in said top inter-metal dielectric layer, each of said at least two top metal lines comprising a topmost metal layer in electrical communication with underlying copper interconnect structures 21 extending through a plurality of inter-metal dielectric layers 19, 22 and 23;

a fuse comprising metal on said top inter-metal dielectric layer (the portion of said metal spanning the distance between said two top metal lines and located directly vertically underneath opening 110), said fuse providing electrical communication between said at least two top metal lines by spanning a distance between said at least two top metal lines (by being integrally connected to said top metal lines; see Figure 15, e.g.);

a protective layer 33/34/38/39 ([0056]-[0058]) comprising a passivation layer (any of 34, 37, 39) on said fuse; and

a window 70 or 110 (see [0012] and [0067], and Figures 12-15) formed through a thickness portion of the protective layer to said passivation layer, said window positioned over a top portion of said fuse (Figures 12-15).

Koike does not necessarily teach the limitation that said fuse comprises aluminum.

However, it would have been obvious to include said limitation in view of Tatematsu et al, who, in a patent application drawn to a semiconductor device with laser blown fuse, hence analogous art, teach that said fuse 15 (see [0057] and [0071]) may be made of aluminum (or, inter alia: copper), hence providing evidence of aluminum being understood in the prior art to be suitable, just as copper is suitable, for fuse material. Applicant is reminded that Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416.

Finally, the pre-amble limitation "to prevent dielectric layer cracking at corner portions of associated metallization structures", aside from not being in the bulk of the claim, constitutes functional language. Applicant is reminded that while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. In re Schreiber, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429,1431-32 (Fed. Cir.

1997) (The absence of a disclosure in a prior art reference relating to function did not defeat the Board's finding of anticipation of claimed apparatus because the limitations at issue were found to be inherent in the prior art reference); see also In re Swinehart, 439 F.2d 210, 212-13, 169 USPQ 226, 228-29 (CCPA 1971);< In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). "Apparatus claims cover what a device is, not what a device does." Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990).

On claim 2: said protective layer on said fuse comprises a dielectric layer (all of layers 33, 34, 38 and 39 are dielectric layers; [0057]-[0058]).

On claim 3: said dielectric layer comprises silicon dioxide.(see layer 34 ([0057]).

2. ***Claims 6, 9, 10 and 11*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US 20022002/0079552 A1) in view of Tatematsu et al (US 2002/0153588 A1) and Hatano et al (7,067,897 B2).

On claim 6: Kioke teaches a semiconductor device fuse structure capable of preventing low dielectric material layer cracking at corner portions of associated metallization structures comprising:

two separated and respectively interconnected metallization structures, each comprising copper (portions of 21 extending into 23 and 29) ([0054]-[0057]), and extending through a plurality of low dielectric material inter-metal dielectric layers 23 and 29 ([0055]-[0056]) (note that SiO_2 has k=3.9; see Sze, page 545).

wherein a fuse comprising metal (metal interconnection copper vias in 29 (Figure 15) vertically below fuse window opening 70 or 110) ([0012] and [0067]) extends

between and electrically interconnects each of the metallization structures in an uppermost inter-metal dielectric layer 29 (N.B.: in view of window opening 70 or 110 34 is not a layer but instead a region); and

a window (70 or 110) is disposed over a top portion of said fuse (Figures 12-15 e.g.), said window extending through a thickness portion of a silicon dioxide layer 34 ([0057]) on said fuse '

Koike does not necessarily teach the limitation that said fuse to comprise aluminum. However, it would have been obvious to include said limitation in view of Tatematsu et al, who, in a patent application drawn to a semiconductor device with laser blown fuse, hence analogous art, teach that said fuse 15 may be made of aluminum (or, inter alia: copper), hence providing evidence of aluminum being understood in the prior art to be suitable, just as copper is suitable, for fuse material. Applicant is reminded that Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416.

Finally, although neither Koike nor Tatematsu et al necessarily disclose the dielectric constant to be in the range implied by the specification, namely k ranging from 2.0 to 3.6, it would have been obvious to include said range in view of Hatano et al, who, in a patent on a semiconductor device with fuse blown by laser radiation (title, abstract and "Summary of the Invention"), hence analogous art, teach low-k dielectric material for multiple inter-metal dielectric films 4 as an equivalent alternative to SiO_2

(see col. 5, l. 59 col. 6, l. 7). Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416.

On claim 9: each of the metallization structures include a first metal layer (laterally elongated portion within 23) and a topmost metal layer (laterally extending edge portions within 29), each of said topmost metal layers connected to said fuse (see, e.g., Figure 15).

On claim 10: the semiconductor device further comprises an etch stop layer 33 ([0056]) (N.B.: silicon nitride is suitable as etch stop material as admitted by applicant in the specification on page 11) on an upper main face and a lower main face (etch stop material silicon nitride forming layer 28, see [0055]) of the uppermost inter-metal dielectric layer 29.

On claim 11: the semiconductor device further comprises a plug extending between the first metal layer and the topmost metal layer (said plug is via connecting said first metal layer and topmost metal layer as defined under claim 9 above) (see Figure 15).

3. ***Claim 12*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Koike, Tatematsu et al and Hatano et al as applied to claim 6 above, and further in view of Admitted Prior Art by Applicant.

Neither Koike nor Tatematsu et al nor Hatano et al necessarily disclose a thickness or thickness range for said aluminum fuse. *However, it would have been*

obvious to include the further limitation on the range of the thickness of the fuse in view of Admitted Prior Art by Applicant (page 3), who teach a range between 500 Angstrom and 5000 Angstrom, which range overlaps with the range as claimed (1000-7000 Angstrom). Applicant is reminded that it has been held that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition overlap the ranges disclosed in the prior art or when the ranges of a claimed composition do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. *In re Peterson, 65 USPQ2d 1379 (CA FC 2003).*

4. ***Claim 13*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Kioke, Tatematsu et al and Hatano et al as applied to claim 9 above, and further in view of Liaw (6,255,715) (previously made of record).

As detailed above, claim 9 is unpatentable over Koike, Tatematsu et al, and Hatano et al, none of these references necessarily teaching the further limitation as defined by claim 13. *However, it would have been obvious to include said further limitation in view of Liaw et al,* who, in a patent on a fuse with guard ring for a semiconductor device or integrated circuit (title, abstract and col. 1, l. 5-18), hence closely related to the art of Koike, teach the thickness of the topmost metal layer 54 to be in the range of between about 2000 and 8000 ´ (col. 6, l. 25-30). *Applicant is reminded* that it has been held that a *prima facie* case of obviousness typically exists when the ranges as claimed overlap the ranges disclosed in the prior art or when the ranges as claimed do not overlap but are close enough such that one skilled in the art

would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003).

5. ***Claims 22-26*** are rejected under 35 U.S.C. 103(a) as being unpatentable over Koike and Tatematsu et al as applied to claim 1 and further in view of Mori (US 2003/0052385 A1).

On claim 22: The semiconductor device defined by the above-stated combination of Koike in view of Tatematsu et al, as delineated above in the rejection of claim 1 can be used and is advocated to be used (Koike, [0017]) as a method of blowing a fuse in a semiconductor device.

Neither Koike nor Tatematsu et al necessarily limit the range of the wavelength as claimed. However, as shown by Mori, a range including 1300 nm = 1.3 μm is conventional for blowing aluminum fuse (20) (see [0051]). Applicant is reminded that it has been held that a *prima facie* case of obviousness typically exists when the ranges as claimed overlap the ranges disclosed in the prior art or when the ranges as do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003). In the underlying case said ranges clearly and substantially overlap.

On claim 23: Koike teaches a fuse passivation layer (either 33 or 34) ([0056]-[0057]) on an upper face of the fuse.

On claim 24: the passivation layer comprises silicon dioxide (see layer 34 in Koike ([0057]).

On claim 25: In the combined invention defined under the rejection of claim 1, an upper face of the fuse comprises aluminum because the fuse taught by Tatematsu et al comprises aluminum ([0057] and [0071]).

6. ***Claim 28*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Koike (US 2002/ 0079552 A1) in view of Tatematsu et al (US 2002/0153588 A1), Hatano et al (7,067,897 B2) and Mori (US 2003/0052385 A1).

Koike teaches a method of blowing a fuse structure capable of preventing low dielectric material layer cracking at corner portions of associated metallization structures, said fuse structure comprising:

a fuse window (70 or 110; Figures 12-15) formed through at least one dielectric layer (38, 39 or both; see [0056]-[0057]) overlying an upper face of a metal fuse (central portion vertically underneath said fuse window; Figure 15) to expose a passivation layer 34 comprising silicon dioxide ([0057]) on said fuse (Figure 15), said fuse window selectively disposed over said upper face of said metal fuse (Figure 15); said metal fuse spanning a distance between two copper metallization structures (central copper portions in 23 and 29; Figure 15 and each comprising interconnected damascene structures (see [0054]) extending through a plurality of low dielectric material layers (19, 23, 29; see [0054]-[0056]); wherein said method comprises directing a laser beam onto said fuse through said silicon dioxide passivation layer ([0005]).

Koike does not necessarily teach said metal fuse to be an aluminum fuse. *However, it would have been obvious to include said limitation in view of Tatematsu et*

al, who, in a patent application drawn to a semiconductor device with laser blown fuse, hence analogous art, teach that said fuse 15 (see [0057] and [0071]) may be made of aluminum (or, inter alia: copper), hence providing evidence of aluminum being understood in the prior art to be suitable, just as copper is suitable, for fuse material. Applicant is reminded that Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416.

Koike does not necessarily teach the dielectric constant to be in the range implied by the specification, namely k ranging from 2.0 to 3.6, it would have been obvious to include said range in view of Hatano et al, who, in a patent on a semiconductor device with fuse blown by laser radiation (title, abstract and "Summary of the Invention"), hence analogous art, teach low-k dielectric material for multiple inter-metal dielectric films 4 as an equivalent alternative to SiO_2 (see col. 5, l. 59 col. 6, l. 7). Applicant is reminded in this regard that it has been held that mere selection of known materials generally understood to be suitable to make a device, the selection of the particular material being on the basis of suitability for the intended use, would be entirely obvious. In re Leshin 125 USPQ 416.

Koike does not necessarily limit the range of the wavelength as claimed. However, as shown by Mori, a range including 1300 nm = 1.3 μm is conventional for blowing aluminum fuse (20) (see [0051]). Applicant is reminded that it has been held that a *prima facie* case of obviousness typically exists when the ranges as claimed

overlap the ranges disclosed in the prior art or when the ranges as do not overlap but are close enough such that one skilled in the art would have expected them to have the same properties. In re Peterson, 65 USPQ2d 1379 (CA FC 2003). In the underlying case said ranges clearly and substantially overlap.

Response to Arguments

Applicant's arguments filed 3/30/06 have been fully considered but they are not persuasive. All elected claims have been substantially amended, necessitating new art rejections based on new references.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P. Mondt whose telephone number is 571-272-1919. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack W. Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JPM
September 4, 2006

Patent Examiner:

Johannes Mondt (Art Unit: 3663)

1.